

BARK MULCH TRIALS
SUMMARY STATUS REPORT

RESEARCH PROJECT 72

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in cooperation with
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Pullman Plant Materials Center

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Introduction

Since 1966 the Department has had a cooperative work agreement with the USDA - Soil Conservation Service (SCS). In 1973, it was proposed that a series of bark mulch trials be carried out under the agreement and with the assistance of the Pullman SCS Plant Materials Center.

The proposal had two objectives. First, bark has been an abundant waste product of the lumber industry in the Pacific Northwest, and development of a beneficial use instead of wasting is attractive. Second, finding an alternative to conventional mulches would be desirable because of the increasing cost of grain straw and grass hay mulches and occasional shortages.

The project consists of two phases. First, test plantings were made in 1974 and 1975 at the Pullman, Washington, facility of the SCS. These were to be evaluated for four years. The second phase involves test plantings at highway construction sites in northern Idaho.

Detailed annual reports have been prepared by SCS. This report summarizes the SCS reports through 1977. If more detailed information is needed, contact the ITD Highway Agronomist.

1974 Pullman Plantings

Soil in the planting area was Palouse silty clay loam similar to that exposed on roadside cuts in northern Idaho and eastern Washington. A year before the plantings, a bedding mulch of sawdust, woodchips and cattle manure had been disked into the surface at a rate of several tons/acre. Seeding was done in April 1974.

Four different seeding mixtures were planted.

1. Idaho standard mixture for Pullman area
(North Idaho Mix #1):

Durar hard fescue	7 lb.
Tegmar intermediate wheatgrass	6 lb.
Manchar smooth brome	3 lb.
Ladak alfalfa	1 lb.
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	17 lb./acre

2. Newport Kentucky bluegrass, representing a small seeded species most likely to be affected by mulch, was seeded at 10 lb./acre.
3. Durar hard fescue, widely used for roadside seedings in eastern Washington, was seeded at 10 lb./acre.

4. Tegmar intermediate wheatgrass was seeded at 10 lb./acre.

Two types of fresh millrun bark mulch were used. Cedar bark was applied at 2, 4 and 8 tons/acre. As an alternative, spruce bark was applied at rates of 4 and 8 tons/acre. For comparison, grass straw mulch was used at a rate of 3000 lb./acre and a commercial mulch (Silvafiber) was applied at 1500 lb./acre. No mulch was used on some plots, to provide a check.

Three different fertilizer conditions were evaluated. Some plots were unfertilized, while others received enough ammonium nitrate to provide 40 or 80 pounds of nitrogen/acre.

Results of 1974 Pullman Plantings

Seed Type	Ground Cover		
	1975	1976	1977
Tegmar	Complete	100%	100%
Idaho Mixture	Complete	98%	98%
Durar	Near Complete	65%	75%
Newport	Less than 20%	11%	14%

Mulch Type	Percent of Mulch Remaining		
	1975	1976	1977
Cedar Bark	50	50-60	45-55
Spruce Bark	90	70	65
Straw	Well Rotted	5	5
Silvafiber	50	0	0

<u>Mulch Type</u>	<u>Rate (tons/acre)</u>	<u>Percent Grass Coverage</u>		
		<u>1975</u>	<u>1976</u>	<u>1977</u>
None	-	Not Reported	57	63
Cedar Bark	2	Not Reported	62	67
Cedar Bark	4	Not Reported	67	68
Cedar Bark	8	Not Reported	75	76
Spruce Bark	4	Not Reported	30-40	30-40
Spruce Bark	8	Not Reported	50	50
Straw	1-1/2	Not Reported	60	60
Silvafiber	3/4	Not Reported	60	60

<u>Nitrogen Rate (lb./acre)</u>	<u>Percent Grass Coverage</u>		
	<u>1975</u>	<u>1976</u>	<u>1977</u>
0	Not Reported	56	62
40	Not Reported	60	64
80	Not Reported	67	69

1975 Pullman Plantings

These plantings were made in the same type of soil as the 1974 trials. The plots were seeded in May 1975.

Twelve pure stands and one mixture were seeded:

<u>Type</u>	<u>Rate, lb./acre</u>
P-274 sheep fescue	10
Draylar upland bluegrass	10
P-727 western bluegrass	15
Idaho standard mixture	20
Sodar streambank wheatgrass	13
P-1822 thickspike wheatgrass	15
Tegmar intermediate wheatgrass	10
Sherman big bluegrass	6
Whitmar beardless bluegrass	13
Alta tall fescue	6
Newport Kentucky bluegrass	10
Durar hard fescue	6
Nordan crested wheatgrass	6

Two types of bark, cedar and spruce, were each applied at air dry rates of 0, 5, 7-1/2 and 10 tons/acre. Five kinds of grass seed straw were used as mulch: Newport bluegrass, Sherman big bluegrass, sheep fescue, Durar hard fescue and Whitmar bluegrass. Straw was used at a rate of 1-1/2 tons/acre. Each straw variety was used only on plots seeded with grass of the same variety as the straw. Silvafiber was applied dry at 1500 lb./acre.

Ammonium nitrate fertilizer was applied at rates sufficient to provide 0, 60 and 120 pounds nitrogen (N)/acre.

Results of 1975 Pullman Plantings

Comparative Performance of Seed Types - Best to Poorest Based on Ground Cover

<u>1976</u>	<u>1977</u>
Idaho Mixture	Idaho Mixture
Tegmar	Tegmar
Sodar	P-727
Alta	Alta
Whitmar	Durar
Nordan	Sodar
Durar	P-274
P-1822	P-1822
P-274	Whitmar
Sherman	Sherman
P-727	Nordan
Draylar	Draylar
Newport	Newport

The Idaho mixture and the top eight grasses had stands above 80% in 1976. The Idaho mixture and the top six grasses had stands above 75% in 1977. All these were judged to provide adequate ground cover. The remaining grasses provided good cover in some areas, but stands were spotty.

<u>Mulch Type</u>	<u>Percent of Mulch Remaining</u>	
	<u>1976</u>	<u>1977</u>
Cedar Bark	50	40
Spruce Bark	70-80	70-80
Straw	25	20
Silvafiber	10	10

Effects of the various mulches on plant cover were the same in 1976 and 1977. Cedar bark at 10 tons/acre reduced the cover about 10%, compared to check areas where no mulch was used. Cedar bark at 5 and 7-1/2 tons/acre didn't reduce the ground cover. Spruce bark at 5 tons/acre reduced ground cover by about 10%. Spruce bark at 7-1/2 and 10 tons/acre reduced cover to 10 to 30%. No significant difference was seen in ground cover among the straw mulches, Silvafiber and check plots.

The effects of 120 pounds N vs. no fertilizer were evident. Fertilized plants were more vigorous and taller. They had about twice the foliage in 1976 and 25% more foliage in 1977, compared to unfertilized plants. Fertilizer had little effect on the percent stand, however.

Conclusions from Pullman Trials through 1977

Overall, the Idaho mixture produced the most complete ground cover and the most foliage. In the mixture, Tegmar produced most of the first year cover. Toward the end of the period, alfalfa and Durar tended to dominate the mixture.

These trials show that several grasses, when seeded under critical area conditions, can provide adequate ground cover during establishment and succeeding years. Tegmar, Sodar and Alta all provided adequate cover during the establishment year and have persisted well. The small seeded bunchgrass, Durar, did not provide adequate cover during the establishment year. During succeeding years it did provide adequate ground cover, but produced less than one-half the foliage of the larger seeded, faster developing grasses and the Idaho mixture.

One hundred and twenty pounds of nitrogen fertilizer applied during the establishment year produced twice the amount of foliage in all grasses the second year; a 25% increase was still noticeable in the third year when compared to the check plots.

Cedar bark appears better than spruce bark for use as a mulch. Spruce bark decreased percent ground cover at application rates of 4 tons/acre and above. Cedar bark mulch increased percent ground cover at rates up to 8 tons/acre; however, a slight decrease in percent ground cover was noted at the 10 ton/acre rate.

1976 Bovill Field Plantings

Based partly on the results of the Pullman trials, several types of grasses and legumes and various mulch treatments were chosen for field trials on a highway construction project. The test area is on Idaho Highway 8, about 8 miles east of Bovill. Seeding was done in October 1976.

Seven types of grass mixtures and pure stands were seeded:

- Idaho standard mixture
- Draylar upland bluegrass
- Tegmar intermediate wheatgrass
- Alta tall fescue
- Manchar smooth brome grass
- Durar hard fescue
- Newport Kentucky bluegrass

All of the above were seeded at 20 lb./acre, but 5 lb./acre of Primar slender wheatgrass seed was added to the Draylar, Durar and Newport to give 25 lb./acre for these three mixtures. Legume plantings consisted of clover, lotus, and alfalfa seeded at 5 lb./acre. All these species trial plots were fertilized with nitrate-phosphate fertilizer at 300 lb./acre. The area surrounding the species plots was seeded with the Idaho mixture at 20 lb./acre.

A mulch blower was used to apply grain straw mulch to the area surrounding the species trial plots. The trial plots were mulched with cedar bark only. Attempts to apply the bark with the mulch blower were unsuccessful. The bark would not feed properly, and chips would fly back out of the hopper, presenting a hazard to the operator. A motor grader was finally used for bark spreading, resulting in bark depths varying from 0 to 6 inches. This gave an average spread rate of about 60 tons/acre. The bark was left loose and no tacking agent was applied.

A separate test area was used to check various mulch treatments. This area was seeded with the Idaho standard mixture at 20 lb./acre. Cedar bark mulch was spread by hand at about the same rate as used on the species plots. Depth was more uniform, however, varying from 1 to 4 inches. Four types of mulch treatments were used: loose bark; bark compacted by a crawler tractor (catwalk); loose bark sprayed with a commercial tackifier intended for use on straw mulch (Terra Tack II); and Terra Tack II applied directly to the ground surface to serve as the mulch. The area surrounding the plots was mulched with grain straw.

1977 Results of Bovill Planting

<u>Bark Depth</u> <u>(inches)</u>	Avg. No. Plants/ft. ² (Species Trial Plots Only)		
	<u>05-03-77</u>	<u>07-06-77</u>	<u>10-06-77</u>
0*	10	4	5
1/4	42	10	9
1/2	20	14	6
3/4	18	3	2
1	10	4	2
1-1/4	1	5	0
1-1/2	3	3	2
1-3/4	1	0	1
2	0	0	0

*Check samples were made in area surrounding the plots.

<u>Variety</u>	Avg. No. Plants/ft. ² (Species Trial Plots Only)		
	<u>05-03-77</u>	<u>07-06-77</u>	<u>10-06-77</u>
Newport	36	24	11
Durar	15	5	3
Manchar	8	1	2
Alta	6	7	3
Idaho Mixture	4	3	2
Tegmar	1	2	1
Draylar	4	6	3
check*	5	2	2

*Counts made in area surrounding the plots.

<u>Mulch Treatment</u>	<u>Avg. Bark Depth/Inches</u>	Avg. No. Plants/ft. ² (Mulch Trial Plots Only)		
		<u>05-03-77</u>	<u>07-06-77</u>	<u>10-06-77</u>
loose bark	3/4	1	4	4
catwalk bark	1/2	4	7	15
tackifier & bark	3/4	5	2	0
tackifier	-	17	24	12
straw	-	50	17	23

Conclusions and Recommendations

1. For seedling survival, the most desirable depth of bark mulch is approximately 1/4-inch. Bark depths greater than 1/2-inch are detrimental.
2. No conclusions can be reached concerning the value of mulch anchoring treatments (no treatment, tackifier and catwalking) because bark depth was too great to allow seedling survival.

3. Seedling survival was essentially the same for the bark mulched and straw mulched areas (species plots).
4. Newport Kentucky bluegrass is well suited to this location.
5. No legume seedlings were found. It is speculated that excessive mulch depth and/or winterkill was responsible.
6. None of the seedlings produced sufficient ground cover during the first year to effectively control erosion. Bark depths greater than one inch prevented erosion. Bark depth of approximately 1/4-inch permitted small amounts of erosion; however, it was less than that observed in the areas covered with straw mulch. Tackifier alone was the least effective erosion control.
7. Standard mulch blowing equipment, without modification, applies the bark well, but is unsatisfactory for use because of feeding problems and flying chips. Spreading bark by hand or with motor patrol is a poor substitute for blowing mulch because of the difficulty in achieving uniform depths.
8. A flap to control the flying chips could be installed on the feeder of the mulch blower. This would allow application of smaller quantities for test plot purposes; however, for larger quantities, the feeder should be modified so that it would move the material into the blower chamber without requiring manual assistance.